

# Inappropriate use of antibiotics in patients undergoing gynecologic surgery

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We retrospectively examined prophylactic antibiotic use and documentation of wound classification in patients having gynecologic surgery at a tertiary hospital. Of the 326 cases reviewed, 175 (54%) received prophylactic antibiotics when not indicated according to guidelines of the American College of Obstetricians and Gynecologists. Antibiotic administration varied significantly ( $P < 0.02$ ) among the different types of surgery, being given in 82% of laparoscopic cases, 35% of nonobstetrical dilation and curettage and operative hysteroscopy procedures, and 51% of open abdominal procedures. There were no recorded episodes of anaphylaxis or pseudomembranous colitis. In conclusion, antibiotic use is high among gynecologic surgeons at a tertiary hospital, but this use was unnecessary.

To improve compliance with publicly reported metrics, our institution developed a preoperative order set that included the Surgical Care Improvement Project (SCIP) guidelines for hysterectomies. Although SCIP recommends prophylactic antibiotics for hysterectomy, the preoperative order sets did not designate gynecologic procedures for which antibiotic prophylaxis use was not recommended. The objective of this study was to examine the use of prophylactic antibiotics in patients undergoing gynecologic surgery at Scott and White Memorial Hospital when antibiotics were not recommended per the American College of Obstetricians and Gynecologists (ACOG) guidelines (1). Our secondary objective was to determine if the surgeries were appropriately classified as to wound type, as this could affect a surgeon's decision on whether or not to give antibiotics.

## METHODS

This retrospective study was performed at Scott & White Memorial Hospital in Temple, Texas. The study was approved by the Scott & White institutional review board prior to data collection as an exempt project not requiring patient consent. All gynecologic surgical procedures performed between January 1, 2012, and December 31, 2013, for which antibiotics were not routinely recommended by ACOG were identified through current procedural terminology codes. Patients were excluded if they were younger than 18 years old, had an infection at the time of surgery that required use of antibiotics, or had concomitant procedures (including nongynecologic surgery) for which

antibiotics were indicated per SCIP guidelines. All data were obtained from the electronic medical record system.

Patients were included only once, even if they underwent multiple procedures. Data were recorded for patient age, body mass index ( $\text{kg}/\text{m}^2$ ), presence or absence of diabetes mellitus, and whether or not the patient was taking steroids or other immunosuppressants. The documented primary wound class (2) was recorded from the operative log. The primary surgeon for each case was recorded and kept confidential. Prophylactic antibiotics were recorded as antibiotics administered up to 1 hour prior to incision on the day of surgery. The charts were reviewed for adverse events (vaginal candidiasis, anaphylactic reactions, hives, rash, diarrhea, *Clostridium difficile* colitis) associated with antibiotic use occurring within 6 weeks postoperatively.

The primary objective was to determine the percentage of cases in which prophylactic antibiotics were administered when not indicated according to ACOG guidelines. An a priori sample of 180 surgeries was calculated to detect a 10% difference of antibiotic administration among three groups: 1) laparoscopy, 2) laparotomy, and 3) transcervical procedures (Table 1). The three groups were divided into subgroups of procedures for further analysis. A total sample size of 320 cases was then calculated to detect a 10% difference in antibiotic administration among the seven subgroups. Cases were selected in a haphazard fashion to represent all surgical subgroups and surgeons. Secondary objectives included determining the accuracy of preoperative wound classification in the operative log compared to the findings documented in the operative report, the number of adverse events in cases where antibiotics were administered, and the variation of antibiotic use among the gynecologic specialties.

Analysis of prophylactic antibiotic administration among groups, subgroups, and gynecologic specialties was performed using the chi-square test. Univariate comparison for associating patient characteristics prior to surgery and prophylactic antibiotic use was analyzed using the Mann-Whitney U test for patient age in years, Student's  $t$  test for patient body mass

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**Table 1. Reviewed procedures by group and subgroup where antibiotic prophylaxis is not indicated**

Group	Procedure	Current procedural terminology codes	Number, % (N = 326)
Laparoscopic procedures	Laparoscopic myomectomy	58545, 58546	16 (5%)
	Operative laparoscopic procedures involving fallopian tubes and/or ovaries, ectopic pregnancy	58660, 58661, 58662, 58670, 58671, 58672, 58673, 58679, 59150	78 (24%)
Transcervical procedures	Dilation and curettage, diagnostic and/or therapeutic (nonobstetrical)	58120	48 (15%)
	Hysteroscopy, endometrial ablation with/without hysteroscopy, and Essure tubal ligation	58555, 58558, 58559, 58560, 58561, 58562, 58353, 58563, 58565	73 (22%)
	Open myomectomy	58140, 58146	6 (2%)
Open procedures	Open tubal ligation	58600, 58605, 58615	49 (15%)
	Open procedures involving the fallopian tubes with/without the ovaries, with/without malignancy	58700, 58720, 58740, 58750, 58752, 58760, 58770, 58805, 58825, 58900, 58920, 58925, 58940, 58943, 58950, 58952, 58953, 58954, 58957, 58958, 58960	56 (17%)

index (kg/m<sup>2</sup>), and chi-square test for presence or absence of diabetes mellitus or steroid use. The statistical comparisons were performed using Statistica software (StatSoft, Tulsa, OK) with *P* values < 0.05 considered significant.

## RESULTS

Among 326 surgical cases reviewed, surgeons ordered prophylactic antibiotics in 175 (54%, confidence interval [CI] 48.1–59.2). The percentage of prophylactic antibiotic administration varied significantly (*P* < 0.02) between each of the major types of surgeries: laparoscopic surgery (82%), nonobstetrical dilation and curettage or operative hysteroscopy (35%), and open abdominal procedures (51%). Antibiotic use did not differ (*P* = 0.82) between laparoscopic adnexal surgery (78%) and open adnexal surgery for benign conditions (76%).

Antibiotic use varied among the four gynecologic specialties (*P* < 0.001). The gynecologic oncology surgeons administered prophylactic antibiotics in 61 out of 65 cases (94%, CI 85%–98%), and the reproductive endocrinology surgeons administered prophylactic antibiotics in 37 out of 39 cases (95%, CI 83%–99%). This pattern was significantly higher than that seen with the urogynecologists and general gynecologists who administered prophylactic antibiotics in 23 out

of 43 cases (53%, CI 38%–69%) and in 53 out of 168 cases (32%, CI 25%–40%), respectively. No significant difference was found between the use of antibiotics by the gynecologic oncologists and reproductive endocrinologists (*P* > 0.05). The general gynecologists were the most compliant with recommended guidelines (*P* < 0.05).

Patients who received inappropriate prophylactic antibiotics were significantly older (*P* < 0.001), but did not differ in body mass index (*P* = 0.06), diabetes (*P* = 0.80), or steroid use (*P* = 0.08). Among those who received inappropriate prophylactic antibiotics, there were 11 (3%) adverse events, but no anaphylaxis or pseudomembranous colitis. Furthermore, 79% of laparoscopic and 89% of open procedures were misclassified as clean-contaminated by the operating room staff (Table 2).

## DISCUSSION

Prophylactic antibiotic use in gynecologic surgeries when not indicated is exceedingly high at this tertiary hospital, with significant variation among major types of surgeries. Fortunately, adverse events remained low, without one recorded episode of *Clostridium difficile* colitis or anaphylaxis. In gynecologic surgery, prophylactic antibiotics are intended to prevent surgical site infection in procedures that expose the abdominal cavity

**Table 2. Recorded wound classifications in operative log**

Subgroup	Clean (N = 36)	Clean-contaminated (N = 232)	Contaminated (N = 4)	Dirty (N = 1)
Laparoscopic myomectomy	1 (7%)	14 (93%)	(0%)	0 (0%)
Laparoscopy adnexa	18 (24%)	57 (76%)	(0%)	0 (0%)
Nonobstetrical dilation and curettage	1 (2%)	46 (96%)	1 (2%)	0 (0%)
Hysteroscopy, ablation, Essure	0 (0%)	70 (96%)	2 (3%)	1 (1%)
Open myomectomy	1 (20%)	4 (80%)	(0%)	(0%)
Open tubal ligation	1 (50%)	1 (50%)	(0%)	(0%)
Open adnexal procedures (benign and malignant)	14 (26%)	40 (73%)	1 (2%)	(0%)

to the polymicrobial flora of the vagina (1). This also includes procedures where instrumentation breaches the endocervix in patients with a history of pelvic inflammatory disease or surgical findings suggestive thereof (e.g., hydrosalpinges).

Although both the reproductive endocrinologists and oncologists had high rates of unindicated prophylactic antibiotics, the postoperative infection rate has historically been much higher with oncology patients in our institution. Theoretically, the scrutiny that the oncologists receive when an infection occurs may have influenced them to order antibiotics for most patients. Although this finding most likely reflects individual practice patterns of a small number of surgeons, it nonetheless emphasizes the need for direct individual outreach and education to challenge dogma and change entrenched practice patterns.

The overuse of prophylactic antibiotics and misclassification of surgical wounds by operating room staff is not unique to our institution. Wright et al (3) identified an overuse rate of 40% and discovered that low-volume surgeons were more likely to order prophylactic antibiotics when not indicated. Low-volume surgeons may not be as familiar with the indications for prophylactic antibiotics. Another explanation is that universal administration of prophylactic antibiotics may be an unintended consequence of systems designed to track and promote adherence to quality measures; physicians may prescribe the antibiotics to prevent scrutiny.

Our high rates of surgical wound misclassification are reflective of previously reported discrepancies between diagnosis-based and circulating nurse-based surgical wound classification (4). As performance on risk-stratified quality measures becomes

increasingly influential in determining reimbursement rates for inpatient care (5), institutions have significant interest in reviewing their ability to accurately record their quality metrics. Failure to do so will not only decrease revenue, but also misdirect future quality improvement efforts and skew public perception of quality of care (4).

This study was limited by its retrospective design and the inability to account for adverse events that were not documented in the patient's record. A notable strength of this study is its reproducibility for other institutions to perform their own internal audit of their quality metric reporting.

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